

NPSAT1 Safety Assessment

Introduction

NPSAT1 is a low-cost, technology demonstration satellite hosting a number of experiments. Commercial, off-the-shelf (COTS)-based technology will be implemented with custom designs to offer a low-cost command and data handling (C&DH) subsystem building on commercial, desktop PC architecture and standards-based specifications. In addition to an experimental C&DH subsystem, NPSAT1 will demonstrate the use of non-volatile ferroelectric RAM which is inherently radiation-tolerant and lithium-ion polymer batteries, state-of-the-art technology that will be employed offering high energy density (Watt-hr/kg) for space applications.

Experiments on-board NPSAT1 include two Naval Research Laboratory (NRL) payloads. The coherent electromagnetic radio tomography (CERTO) experiment and a Langmuir probe. The CERTO experiment is a radio beacon which, in concert with ground station receivers, is used to measure total-electron-content (TEC) in the ionosphere. The Langmuir probe will augment CERTO data by providing on-orbit measurements. The other experiments are of NPS origin. These include a novel design for a spacecraft computer board, a COTS visual imager (VISIM), and some micro-electromechanical systems (MEMS)-based rate sensors.

Description of Thesis Topic

NPSAT1 will be launched as a secondary payload on the Evolved Expendable Launch Vehicle (EELV) Delta IV. The Delta IV will provide a medium lift capability in the EELV class of launch vehicles. NPSAT1 will be mated to the Delta IV using the EELV Secondary Payload Adapter (ESPA). The design and operations of NPSAT1 will require that the space vehicle pose no hazards to ground support equipment, personnel, the launch vehicle, or other payloads. Potential hazards include structural failure, inadvertent deployment of antennas or other mechanisms, inadvertent radio frequency emissions, and other hazards.

The scope of this thesis is to assess the safety risks associated with NPSAT1 for all activities occurring at the launch site through orbit insertion. This includes ground testing at the integration site, as well as, in-flight operations prior to and shortly after separation from the launch vehicle. All hazards associated with NPSAT1 are to be enumerated and assessed for criticality. Hazard mitigation is to be presented preferably through subsystem design, but may also be performed through operations.

Proposed Outline

- NPSAT1 Introduction
- Overview of Launch Vehicle Safety and Payload Safety
- NPSAT1 Safety Issues
- Classification of NPSAT1 Safety Hazards
- Hazard Mitigation
- Conclusions & Recommendations
- Appendix of Test Results and Test Data

Suggested References

- NPSAT1 PDR Slides
- Chuck Reuer Thesis on NPSAT1
- EWR 127-1 Range Safety Document